

Report on July 5, 2011 Storm Event at the Ivanpah SEGS Construction Site August 10, 2011 Business Meeting Informational Item

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The Ivanpah Solar Electricity Generating System (SEGS) power plant is under construction in the southern California desert near the Nevada border. The site covers about 3,633 acres in the Ivanpah Valley just north of I-15 (see Figure 1). The project consists of three power blocks and one common area with shared facilities, generating about 385 MW. On July 5, 2011, a storm occurred at the project construction site over a 2 to 4 hour period, with the highest intensity occurring over nearly a two hour period. Based on rainfall gauge data, the storm can be categorized as having a recurrence interval of 10- to 25-years. For reference, when the project is completed, the Ivanpah SEGS facility design will accommodate storms up to a 24-hour, 100-year storm for storm water approaching and leaving the project site and for a 24-hour, 25-year storm for storm water within the power block and administration building areas. Based on weather data from Nipton, California, there have been five other precipitation events since the July 5 storm event, all less intense than the July 5 storm. However, the storms in this area tend to be highly localized. Examples of the July 5, 2011 storm flows are presented in Photos 1 through 4 below.



Photos 1 - 4. Storm water flow in the Common Area. The soil in this area is disturbed.

Energy Commission staff visited the project site a few days after the storm to observe the effect of the storm at the project construction site and site vicinity, and to observe the effectiveness of the project erosion and sedimentation control measures. The summary and recommendations herein are based on the information available to date. Staff will continue to work with the project owner and Chief Building Official to monitor construction activities and the efficacy of storm water management best practices.

The storm visibly affected the areas with disturbed soil, and in particular, areas under construction, much more than the areas of relatively undisturbed soil. In the undisturbed soil areas, the natural drainages appeared unaltered. Installed pylons, ring roads, and mowed vegetation did not appear to accelerate erosion or sedimentation (Photos 5 - 6). However, the installed tortoise fence trapped vegetation that floated on the storm water and matted against the fence wiring (Photo 7). This matting created a dam trapping water and up to 1.5 feet of sediment (Photo 8). At other areas, the tortoise fence failed due to the volume of water and sediment trapped behind it (Photo 9). In some areas, tortoise guards filled with sediment (Figure 10). In other areas, the stream bed eroded across roads, back down to the stream's baseline equilibrium, and exposed the bottom of the tortoise fence (Photo 10). In still other areas, the storm water flowed along the fence line parallel to the natural slope, eroding sediment along the fence line (Photo 12). The sediment along the fence line was less compacted than the sediment in the road and may have been more susceptible to erosion.

In the disturbed areas, three main areas under construction were impacted. A culvert under construction drained into an open utility trench, also under construction, filling the trench with storm water until the storm water breached the trench walls and flooded down slope. A drainage channel under construction filled with sediment and sediment clogged a down slope culvert that was under construction. A diversion berm, under construction, concentrated storm water flow to a linear silt fence down slope of the well pad/switchyard area (Photos 13 through 17). The silt fence not installed in accordance with California Stormwater Quality Association (CASQA) Best Management Practices (BMPs). The silt fence caused further concentration of the storm water flow until the silt fence failed to withstand the pressure of the sediment and water it was holding and flooded the down slope parking, construction trailers, and fabrication buildings area. The improper use of the silt fencing¹ and its subsequent failure resulted in the erosion and sedimentation shown in Photos 1 - 4.

In response to the storm, BrightSource inspected the tortoise pens, and inspected and repaired the perimeter security and tortoise fences. They initiated repairs to the Common Area and identified any areas where security and tortoise fences were damaged using GPS, and began evaluation of implementing new storm water measures. These potential measures have not yet been finalized or submitted to the Energy Commission. Within the project site, no tortoises were adversely affected by the storm. Also, there were no water quality impacts associated with this storm. A timeline of events is presented in the table below.

¹ According to CASQA, silt fencing is intended to detain sediment-laden water to allow sedimentation behind the fence, and should not be used to divert flow or where flow is concentrated, where ponded water may cause flooding, or on a slope or across any contour line. Improperly installed silt fencing is subject to failure from undercutting, overtopping, or collapsing.

Date	Event of Action
July 5	A 10- to 25-year storm occurred at the project site. Due to concerns associated with lightening strikes, onsite personnel were told to stay in their vehicles or onsite buildings until the threat passed. Precipitation occurred over a 3 to 4 hour time interval with the ground becoming saturated after one hour of precipitation. Upper portions of the bajada experienced more intense and a higher volume of precipitation than did the lower portions.
July 5 to July 11	Tortoise pens were checked and were not damaged by the storm event. Perimeter tortoise and security fencing was inspected and repaired where necessary. Damaged areas were identified using GPS. New storm water measures began to be evaluated.
July 11	Energy Commission staff inspected the site.
July 11 to July 29	Evaluation of new storm water control measures began. A plan was made to use K-rails to divert future stormwater flow from the diversion berm to the Ivanpah 1 heliostat field. Future diverted storm water flow would be reintroduced as sheet flow within the heliostat field.
July 19 and 28	The Energy Commission Siting Committee received briefings on the storm event.
Current	The Energy Commission has requested removal of the silt fence between the switchyard/well pad and parking/laydown areas or moving the silt fence to the toe of the switchyard/well pad slope. K-rails will likely be installed to divert storm flow to the solar field of Ivanpah 1 and dissipation structures will be installed at the ends of the K-rail to reintroduce the diverted flow as sheet flow.

Based on a review of the impact to the project site from the storm water, Energy Commission staff has made the following recommendations:

- Complete the storm water diversion berm up slope of the Common Area. Completion of the diversion berm hinges on the design and construction of an associated culvert, which needs to be coordinated through the Los Angeles Department of Water and Power and the project owner. Once completed, the berm will divert storm flow to the heliostat field of Ivanpah 1, where the flow will be dissipated and reintroduced as sheet flow to allow the naturally developed drainage system to carry the flow.
- Temporary storm water controls should be applied as needed during construction as disturbed soils and graded areas seem particularly vulnerable to damage from storm water flows.
- Stormwater controls that can be used during project construction and operation may include check dams on Category 1 and 2 drainages, particularly for drainages in Units 2 and 3 heliostat fields. These storm water controls should be designed to reduce storm water runoff velocity and disperse storm water volume over a greater distance so that downstream fences and roads are protected.
- Use silt fencing in accordance with the recommendations of CASQA.
- The silt fence between the well pad/switchyard area and the temporary trailer, parking, and fabrication area should be removed or modified to mitigate erosion across the fabrication pad and excessive sedimentation offsite while maintaining protection of adjacent property along the Southern California Edison easement.
- Energy dissipation devices should be placed downstream of culverts in the Common Area and in any water diversion channels that can carry sediment that can impact downstream culverts.

- Sediment management will be required throughout the life of the project. This will include sediment removal and sediment backfill along impacted sections of fencing where erosion or sedimentation has occurred. This is required by the Energy Commission's license (Condition of Certification SOIL&WATER-5).
- Security and tortoise fence repairs will be required throughout the life of the project. This is required by the Energy Commission's license (Condition of Certification SOIL&WATER-5).



Photo 5. Ivanpah 1 Pylon Field. Vegetation has been mowed and ring roads cut in Ivanpah 1. No significant erosion or sedimentation change. This view is looking up slope.

Photo 6. Pylon in Stream Channel. No scour or sedimentation evident around this pylon, while others had some scour. This view is looking down slope in Ivanpah 1.





Photo 7. Matted Vegetation. This is an example of the vegetation mat/dam that formed on the tortoise fencing. The fencing is parallel to the ground slope.

Photo 8. Bowed Tortoise Fence. The vegetation mat/dam trapped the sediment which caused the tortoise fence to bow out. The stream channel slopes down towards the right.





Photo 9. Failed Tortoise Fence. The vegetation mat trapped sediment behind it which caused failure of the tortoise fence. This view is looking down slope.

Photo 10. Tortoise Guard Filled with Sediment. Storm water carried sediment to this guard, depositing sediment until it filled the guard. This view is looking up slope.

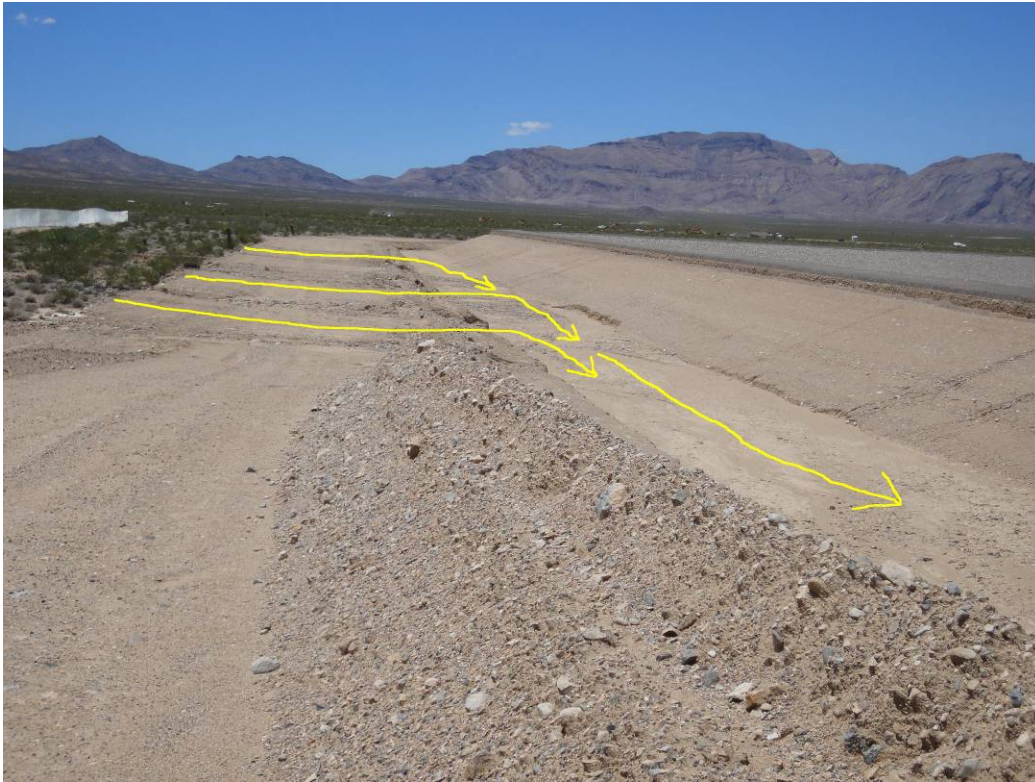




Photo 11. Streambed Eroded Back to its Baseline. This streambed eroded back until it equilibrated with its baseline, causing the bottom of the tortoise fence to be exposed. This view is looking down slope.

Photo 12. Fence Line Erosion. Erosion along the fence line paralleled the slope direction. Erosion may have been caused by the storm water preferentially eroding the non-compacted soil along the fence rather than the compacted soil of the road. This view is looking up slope.





Photos 13 above and 14 below. Concentration of Storm Water by the Diversion Berm. The pictures above and below show the direction of storm water flow along the incomplete protective berm upslope of the Common Area. This berm is still under construction.





Photos 15 above and 16 below show how the storm water flow was concentrated by the silt fencing. Continuing from the previous pictures, the picture

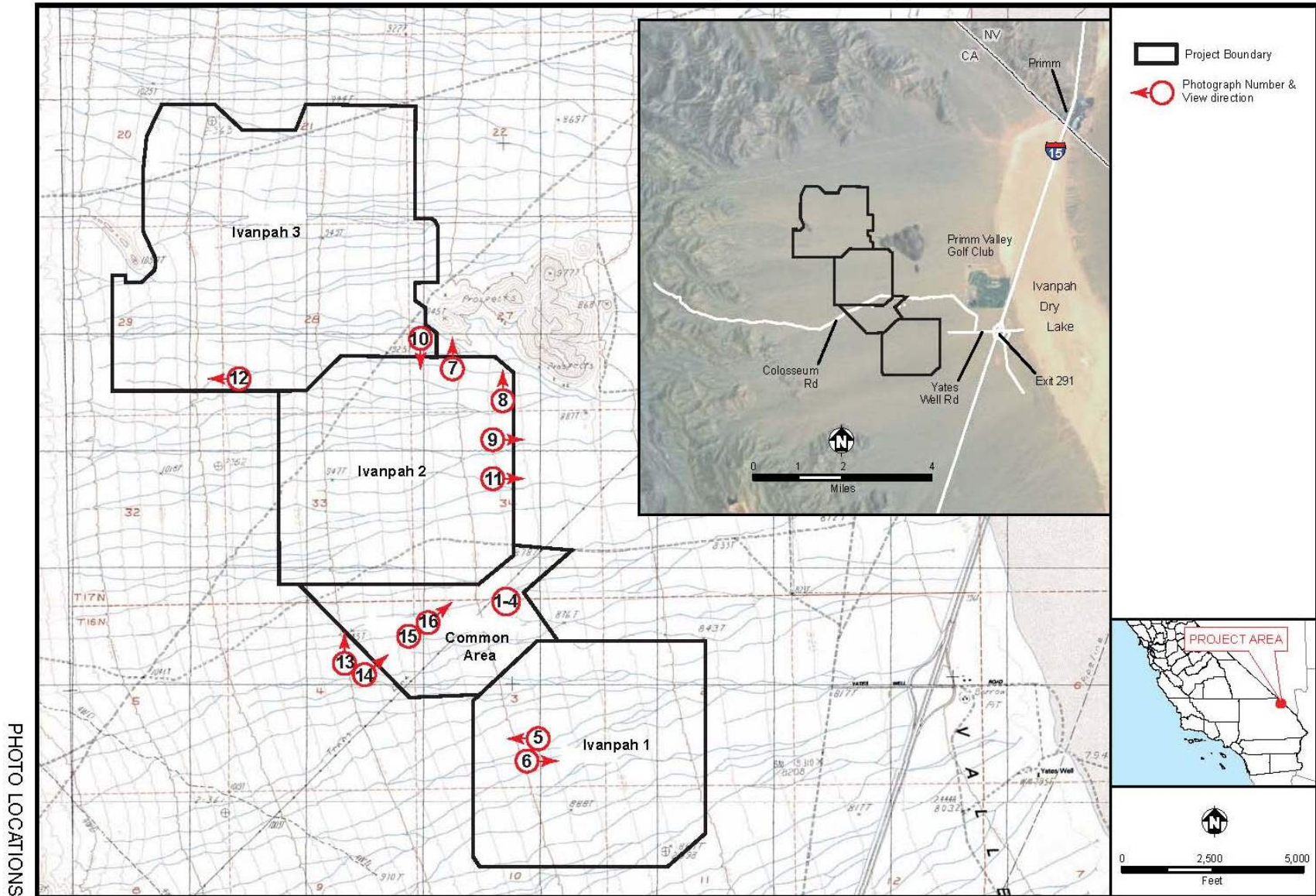
above and below shows the direction of storm water flow down slope towards parking, construction trailers, and fabrication buildings area. Areas circled in red show where the storm water flow blew out the silt fencing. The silt fencing was not installed in this area in accordance with CASQA BMPs. The silt fencing helped concentrate the storm water flow and accelerate erosion and eventual sedimentation.





Photo 17. Storm Water and Sediment Flow to the Parking and Trailer Area. This picture shows the amount of sedimentation (arrows to the left) and erosion (arrow to the right) in the trailer area. This erosion and sedimentation resulted from the incomplete construction of the diversion berm and installation of silt fencing that concentrated the storm water and sediment flow to this area.

PHOTO LOCATIONS - FIGURE 1
Ivanpah Solar Electric Generating System - Local Setting



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 SOURCE: CEC Staff